Geology of the Niagara Escarpment

Ontario's Niagara Escarpment

The Niagara Escarpment is recognized as one of the world's unique natural wonders.

Essentially, it is a landform - **a ridge of rock several hundred metres high in some locations - stretching 725 kilometres (450 miles) from Queenston on the Niagara River to Tobermory at the tip of the Bruce Peninsula.**

It contains a rich mosaic of forests, farms, recreational areas, wildlife habitats, dramatic scenic views, cliffs, hills, waterfalls, mineral resources, historic and archaeological sites, industrial sites, populated urban centres, villages and hamlets.

Today, in Ontario, the Escarpment contains more than 100 sites of geological significance including some of the best exposures of rocks and fossils of the Silurian and Ordovician Periods (405 to 500 million years old) to be found anywhere in the world.

Escarpment natural areas contain more than 300 species of birds, 53 species of mammals, 36 species of reptiles and amphibians, 90 fish species and 100 varieties of 'special interest flora' including 37 types of wild orchids.

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Geological History

The Niagara Escarpment is a massive topographic feature with origins dating back into geological history some **430 to 450 million years**, a time when the area lay under a shallow warm sea. This sea lay in a depression of the earth's crust, the centre of which is now the State of Michigan. Now geologically known as the Michigan Basin, the outer rim of this massive saucer - shaped feature governs the location of the Niagara Escarpment.

In the shape of a gigantic horseshoe the Escarpment can be traced from near Rochester, New York, south of Lake Ontario to Hamilton, north to Tobermory on the Bruce Peninsula, beneath the waters of Lake Huron to appear again on Manitoulin Island, across northern Michigan and down the west side of Lake Michigan into the State of Wisconsin.

As occurs with present day water bodies such as Hudson Bay or the Gulf of Mexico, rivers flowing into this ancient sea carried sand, silt and clay to be deposited as thick layers of sediment. At the same time lime-rich organic material from the abundant sea life was also accumulating. Over millions of years these materials became compressed into massive layers of sedimentary rocks and ancient reef structures now visible along the Escarpment. Some rock layers now consist of soft shales and sandstones while others are made up of dolostone (a rock similar to limestone which contains magnesium and is more durable).

Today, fossil remains illustrating the various life forms can be found in many of the rocks as they are slowly exposed by the action of wind, water and ice.

The Location and Structure of the Niagara Escarpment

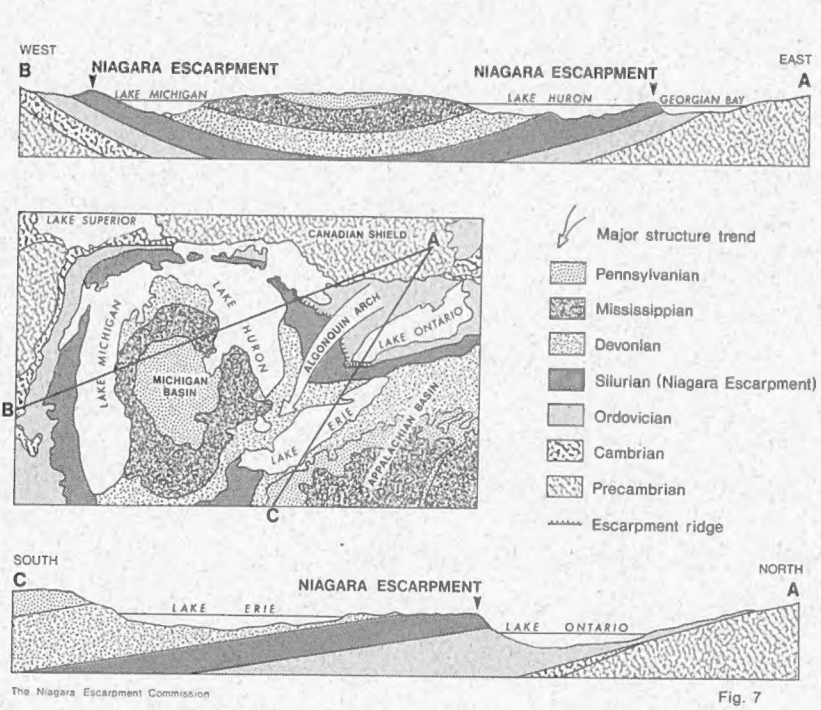

Fig. 7

The Niagara Escarpment is a geologist's paradise and contains some of the best exposures of rocks and fossils of the Palaeozoic Era found anywhere in the world.

As a landform, the Escarpment began to form only after the ancient sea withdrew some 300 million years ago.

Over succeeding millions of years erosive agents slowly removed the softer shales underlying the more resistant dolostone layers.

As the softer underlying material was eroded away , large blocks of the resistant dolostone caprock broke off creating the vertical face of the present day Escarpment.

Though of pre-glacial origin, the Escarpment face has been dramatically altered by successive advances of Pleistocene ice sheets over the last one to two million years.

The erosive power of the glaciers can be observed in several places - such as the widening and deepening of the Beaver Valley or the numerous rock fragments and boulders carried miles from the Escarpment and deposited in massive moraines.

This mass of material deposited by the ice and ensuing meltwater, covering the rock as much as several hundred feet in places, was even more important in modifying the appearance of the Escarpment. Glaciation, therefore, has made it very difficult for an observer to determine the exact location of the Escarpment in areas such as Mono Township and Caledon.

Weathering and erosive forces that initially carved the Niagara Escarpment are the same ones still occurring today. These include running water, waves, frost action, ice and wind.

Running water and waves have created the most dramatic results. The effect of the wave action is well illustrated along the shores of Georgian Bay in the Bruce Peninsula, while the erosive force of running water is best displayed in the Niagara Gorge, which has been carved by the Niagara River over approximately the last 13,000 years following glaciation.

Erosion at the headwaters of the numerous streams rising on the Escarpment is largely responsible for the many indentations and irregular appearance of the Escarpment face. Outliers, or segments of the Escarpment separated from the main face such as at Milton are also the result of stream erosion.

The Sapping Process

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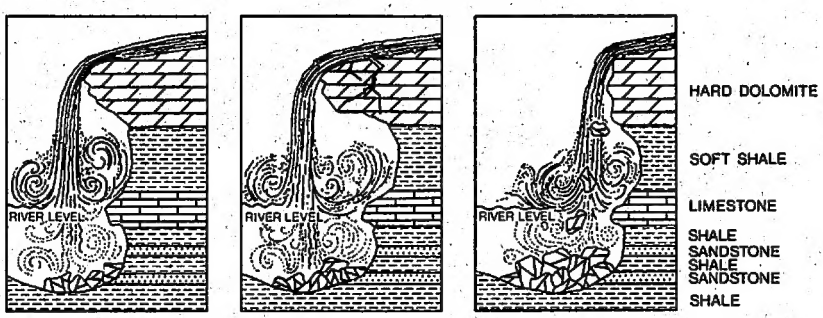
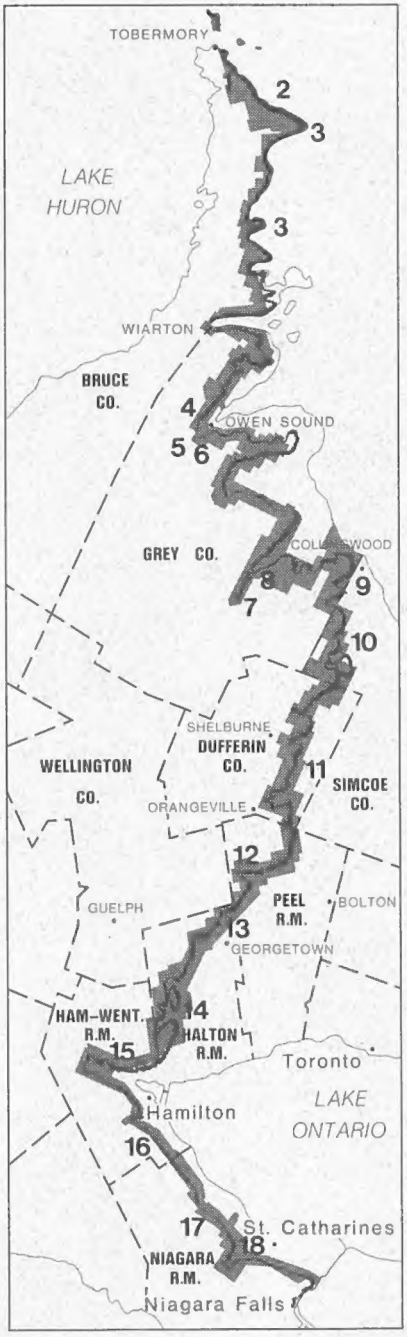


The Niagara Escarpment Commission

Less obvious, but important, is the chemical weathering process whereby the porous dolostones are dissolved, creating karst features such as sinkholes and caves and leading to numerous springs along the base of the Escarpment. Good examples of sinkholes can be found on the west side of the Beaver Valley near Wodehouse and at St. Edmunds Cave at the top of the Bruce Peninsula.

Also, frost action is continually loosening large blocks of rock from the face creating a talus slope below.

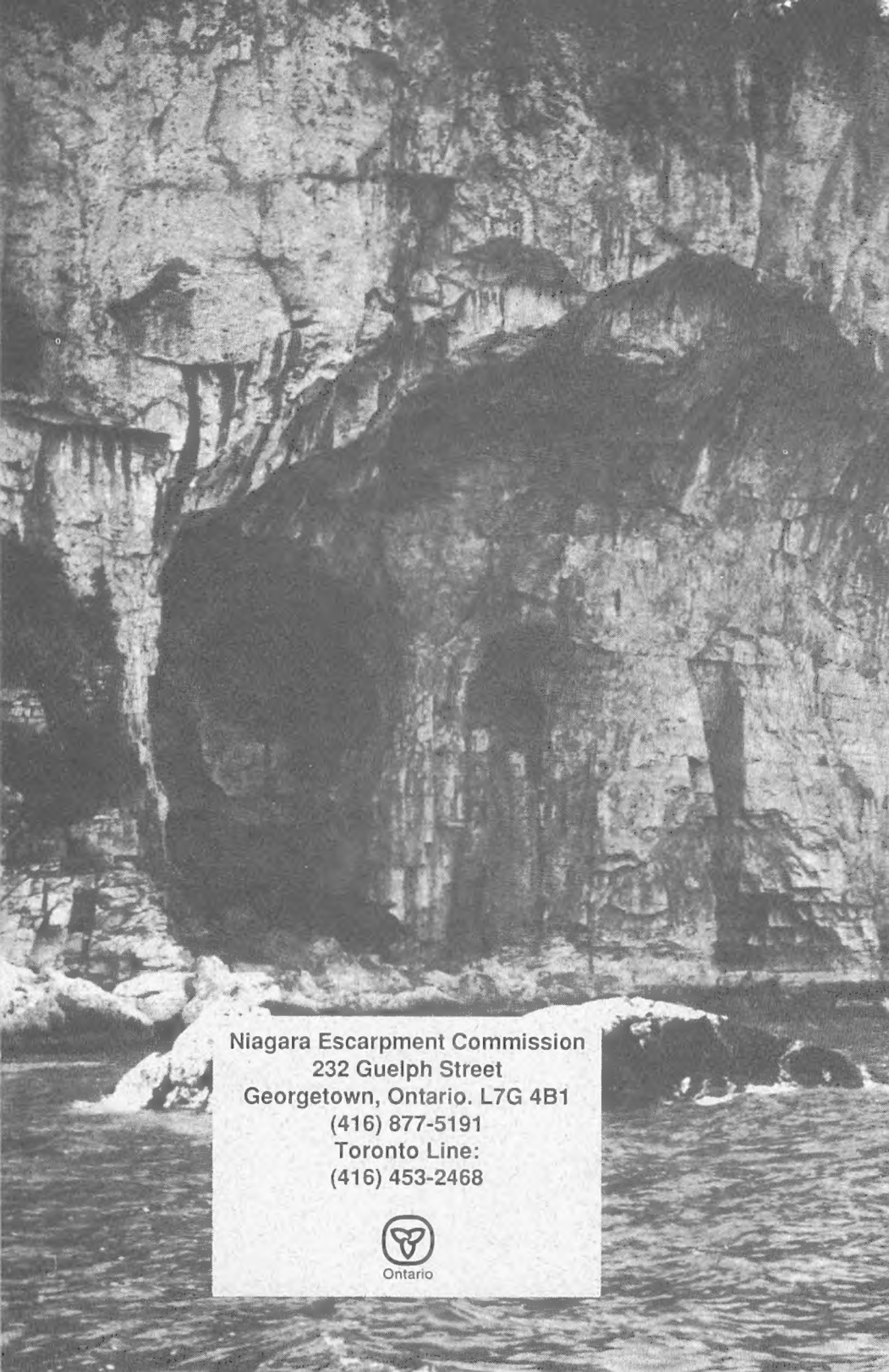
The Niagara Escarpment thus continues to slowly change by the same process that led to its creation.



Geological Features

Other places along the Escarpment containing interesting, prominent geological features accessible to the public (and of high scenic value) can be found at:

1. Cyprus Lake
2. Rocky Bay and Cove Point
3. Lion's Head and Cabot Head
4. Indian Falls Conservation Area
5. Pottawatomi (Jones Falls) Conservation Area
6. Inglis Falls Conservation Area
7. Eugenia Falls Conservation Area
8. "Old Baldy"
9. Blue Mountain Caves
10. Devil's Glen Provincial Park
11. Mono Cliffs Provincial Park
12. Cataract Falls
13. Hilton Falls Conservation Area
14. Mount Nemo
15. Webster's Falls and Tew's Falls in Spencer Gorge Conservation Area
16. Devil's Punch Bowl Conservation Area
17. Ball's Falls Conservation Area
18. Decew Falls



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